Effect of Heterogeneity Structure on Estimation Uncertainty for a Calibrated Seepage Model

Stefan Finsterle and Teamrat A. Ghezzehei

Earth Sciences Division, Lawrence Berkeley National Lab
1 Cyclotron Rd., MS 90R1116, Berkeley, CA 94720-8126, USA
Tel 1-510-486-5688, Fax 1-510-486-5686 Email TAGhezzehei@lbl.gov
Tel 1-510-486-5205, Fax 1-510-486-5686 Email SAFinsterle@lbl.gov

Dripping of water into underground openings is significantly affected by the heterogeneity of the geologic formation. Calibration of numerical models against field seepage data is a method for estimating effective, seepage-related properties of the geologic formation surrounding the openings. The van Genuchten α parameter is considered the primary seepage-related parameter of a three-dimensional, heterogeneous (with respect to permeability) continuum model. Each seepage data set is obtained from a certain test bed that can be considered one realization from a number of statistically similar geologic systems. The lack of knowledge regarding the details of this specific realization makes the inversely determined α parameter estimate uncertain. This uncertainty is analyzed by performing multiple inversions of the same data set using different realizations of the underlying heterogeneous permeability field, which generates a probabilistic distribution of the estimated α parameter. Knowledge of how the heterogeneity structure affects the estimation uncertainty is very important, because permeability data are usually sparse and multiple inversions are computationally intensive. The objective of this study was to analyze how the geostatistical parameters of the permeability field affect the distribution of the estimated α parameter. We calibrated a seepage model with a circular tunnel against synthetic seepage data, assuming uniform percolation flux at the upper end. Inversions were performed for wide ranges of geostatistical parameter values.

This work was supported by the Director, Office of Science, Office of Basic Energy Sciences, Division of Chemical Sciences, Geosciences, & Biosciences, of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.

Session: H07 Recent Advances in Groundwater Hydrology (POSTER)
Index: 1869, 1899

Total Characters: 1934